APPENDIX D. ACCIDENT ANALYSIS

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APPENDIX D. ACCIDENT ANALYSIS

This appendix provides detailed information on the management of spent nuclear fuel (SNF). The information includes potential accident scenarios for new, modified, and existing facilities that the U.S. Department of Energy (DOE) would use for each alternative. The appendix provides estimates of the quantity and composition of hazardous materials that could be released in an accident as well as the consequences to workers and the public, estimated in terms of dose and latent cancer fatalities for radiological releases and of concentration levels for chemical releases.

The sources of information for the accident analyses for existing facilities are safety analysis reports and basis for interim operation documents. For new or modified facilities the sources vary, depending on the processes involved. In general, DOE performed detailed hazard assessments to identify potential significant accidents, basing the determination of significance on the existence of sufficient energy sources and hazardous materials that, if released, would impact workers or the public. The following sections provide specific information on the hazards assessments for the alternatives.

D.1 General Accident Information

An accident, as discussed in this appendix, is an inadvertent release of radiological or chemical hazardous materials as a result of a sequence of one or more probable events. The sequence usually begins with an initiating event, such as a human error and explosion, or earthquake and structural failure, followed by a succession of other events that could be dependent or independent of the initial event, which dictate the accident's progression and the extent of materials released. Initiating events fall into three categories:

- *Internal initiators* – normally originate in and around the facility but are always a result of facility operations. Examples include equipment or structural failures, human errors, and internal flooding.

- *External initiators* – are independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples include aircraft crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.

- *Natural phenomena initiators* – are natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, and snow. Although natural phenomena initiators are independent of external facilities, their occurrence can involve those facilities and compound the progression of the accident.

The likelihood of an accident occurring and its consequences usually depend on the initiator and the sequence of events and their frequencies or probabilities. Accidents can be grouped into four categories—anticipated, unlikely, extremely unlikely, and not reasonably foreseeable, as listed in Table D-1.

DOE based the frequencies of accidents at existing SNF management facilities on safety analyses and historical data about event occurrences. For proposed new facilities without design details, DOE based the accident frequencies on hazard analyses, historical data for similar facilities and operations, and best estimates. For all facilities, DOE analyzed the bounding accident in appropriate accident classes (e.g., natural phenomena hazards, operational errors, external events), such as the worst case fire, to represent all other accident in that class.

Table D-1. Accident frequency categories.

Accident Frequency category	Frequency range (occurrences per year)	Description
Anticipated	Less than once in 10 years but greater than once in 100 years	Accidents that might occur several times during facility lifetime
Unlikely	Less than once in 100 years but greater than once in 10,000 years	Accidents that are not likely to occur during facility lifetime; natural phenomena include Uniform Building Code-level earthquake, maximum wind gust, etc.
Extremely unlikely	Less than once in 10,000 years but greater than once in 1,000,000 years	Accidents that probably will not occur during facility life cycle; this includes the design-basis accidents
Beyond extremely unlikely	Less than once in 1,000,000 years	All other accidents

TC
EC
TC

Source: DOE (1994).

D.2 Accident Analysis Method

DOE tailored the methods it used to analyze potential accidents to the specific situation. For accidents that could result from operations at existing facilities, the analysis used the applicable impacts described in existing safety analysis documents. For these facilities the analysis included no new modeling; through a screening process, it included only accident scenarios pertaining to operations related to SNF management. Depending on the alternative, one or more new facilities or major modifications to existing facilities could be required. For example, a new Transfer and Storage Facility would be common to many, but not all, of the alternatives. Some alternatives would require the construction of a new treatment component to operate in conjunction with the Transfer and Storage Facility. For these new facilities, hazard analyses were performed to identify bounding accident scenarios, as explained below. The identified accidents were modeled for radiological impacts (Simpkins 1997) using the AXAIRQ computer code (Simpkins 1995a,b), which is described in this section.

The accident sequences analyzed in this EIS would occur at frequencies generally greater than once in 1,000,000 years. However, the analysis considered accident sequences with smaller frequencies if their impacts could provide information important to decisionmaking.

D.2.1 TECHNOLOGIES AND RELATED FACILITIES

DOE has organized the accident data in this appendix by the facilities it would use for each alternative. Table D-2 lists the technologies and the corresponding facilities that DOE would use to implement each. DOE organized the accident impacts in Chapter 4 by technology to reflect potential accident occurrences for the associated facilities listed in Table D-2.

Table D-2 also lists applicable types of fuel that DOE would treat and manage under each alternative. The accident analyses performed for each facility and alternative do not take explicit account of specific fuel properties and characteristics. Rather, the analyses defined a reference fuel assembly (RFA; Appendix C) and furnace batch equivalent (FBE; WSRC 1998) amounts of material at risk (MAR). The FBE MAR was used to analyze all events for all new treatment technologies and the RFA MAR for events related to SRS wet basins and SRS canyons. TC

D.2.2 RADIOLOGICAL HAZARDS

The analysis used the computer code AXAIRQ to model accidental atmospheric radioactive releases from the Savannah River Site (SRS) that are of relatively short duration. AXAIRQ strictly follows the guidance in Regulatory Guide 1.145 (NRC 1982) on accidental releases, and has been verified and validated. The release can originate from a vent or stack and release heights can be from 0 to 100 meters (0 to 328 feet), as appropriate for the scenario. The code considers terrain for elevated releases. In accordance with the regulatory guide, it considers plume meander and fumigation under certain conditions. Plume rise due to buoyancy or momentum is not available. The program uses a 5-year meteorological data base for the Savannah River Site, and determines the shortest distance to the Site boundary in each of the 16 sectors by determining the distance to one of 875 locations along the boundary. The code uses the shortest distance in each sector to calculate the concentration for that sector. DOE used PRIMUS, which was developed by the Oak Ridge National Laboratory, to consider decay and daughter ingrowth.

The analysis assumes that all tritium released would have the form of tritium oxide and, following International Commission on Radiological Protection methodology, the dose conversion factor for tritium has been increased by 50 percent to account for absorption through the skin. For population dose calculations, age-specific breathing rates are applied, but adult dose conversion factors are used. Radiation doses were calculated to the maximally exposed offsite individual (MEI), to the population within 50 miles of the facility, and to an uninvolved worker assumed to be 640 meters (2,100 feet) downwind of the facility.

After DOE calculated the total radiation dose to the public, it used dose-to-risk conversion factors established by the National Council on Radiation Protection and Measurements (NCRP) to estimate the number of latent cancer fatalities that could result from the calculated exposure. No data indicate that small radiation doses cause cancer; however, to be conservative the NCRP assumes that any amount of radiation has some risk of inducing cancer. DOE has adopted the NCRP factors of 0.0005 latent cancer fatality for each person-rem of radiation exposure to the general public and 0.0004 latent cancer fatality for each person-rem of radiation exposure to radiation workers (NCRP 1993).

D.2.3 CHEMICAL HAZARDS

For chemically toxic materials, the long-term health consequences of human exposure to hazardous materials are not as well understood as those related to radiation exposure. A determination of potential health effects from exposures to chemically hazardous materials, compared to radiation, is more subjective. Therefore, the consequences from accidents involving hazardous materials are expressed in terms of airborne concentrations at various distances from the accident location, rather than in terms of specific health effects.

To determine the potential health effects to workers and the public that could result from accidents involving hazardous materials, the airborne concentrations of such materials released during an accident at varying distances from the point of release were compared to the Emergency Response Planning Guideline (ERPG) values (AIHA 1991). The American Industrial Hygiene Association established these values, which depend on the chemical substance, for the following general severity levels to ensure that the necessary emergency actions occur to minimize exposures to humans.

- ERPG-1 Values. Exposure to airborne concentrations greater than ERPG-1 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience mild transient adverse health effects or perception of a clearly defined objectionable odor.

- ERPG-2 Values. Exposures to airborne concentrations greater than ERPG-2 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop irreversible or other serious health effects or symptoms that could impair a person's ability to take protective action.

- ERPG-3 Values. Exposure to airborne concentrations greater than ERPG-3 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop life-threatening health effects.

Not all hazardous materials have ERPG values. For chemicals that do not have ERPG values, a comparison was made to the most restrictive available exposure limits established by other guidelines to control worker accidental exposures to hazardous materials. In this document, the ERPG-2 equivalent that is used is the PEL-TWA (Permissible Exposure Limit – Time Weighted Average) from 29 CFR Part 1910.1000, Subpart Z.

D.3 Impacts of Postulated Accidents Involving Radioactive Materials

TC These sections describe the potential accidents and risks associated with the operation of each facility that may be utilized in the implementation of a technology. The impacts of each technology are shown in Sections D.3.5 to D.3.8. The material at risk in all treatments is the same, only the release fractions change. For these cases, over 95 percent of the calculated doses come from the release of plutonium-240 and curium-244. The only exception to this are criticality accident scenarios when over 99 percent of the dose comes from the release of ruthenium-106.

D.3.1 H-CANYON AND FB-LINE

Tables D-3 and D-4 summarize potential accidents and their impacts for the H-Canyon and FB-Line facilities, respectively (WSRC 1993, 1995; TtNUS 1999b). TC

D.3.2 RECEIVING BASIN FOR OFFSITE FUEL

Potential accidents and their impacts for the Receiving Basin for Offsite Fuel (RBOF) facility have been documented in a safety analysis report (WSRC 1997a). Table D-5 lists the accidents with the highest risks and consequences.

D.3.3 REACTOR DISASSEMBLY BASIN

Potential accidents and their impacts for the L-Reactor Disassembly Basin have been documented in a basis for interim operation report (WSRC 1997b). Table D-6 summarizes the results.

D.3.4 TRANSFER AND STORAGE FACILITIES

DOE could collocate the transfer and storage facilities either in separate buildings or in a single building. The accident impacts associated with the operation of these facilities apply to both cases and assume the location of the facilities in L-Area.

D.3.4.1 Transfer Facility Accidents

Radioactive Material Leaks From Shipping or Storage Cask (TS-1)

Radioactive materials could leak from shipping or storage casks. In this accident sequence, radioactive material would leak to the surface of the shipping or storage cask and a small amount would become airborne. The principal radionuclides would be cesium-137, cerium-144, ruthenium-106, and strontium-90. The total curies released in this scenario would 1.0×10^{-7} and would result in negligible consequences. This event is postulated to occur once in 10 years of operation. The calculated consequences for this scenario are listed in Table D-7.

Table D-3. H-Canyon radiological accidents and impacts.[a]

	Accident consequences

Accident	Maximum curies released	Accident frequency	Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Ruthenium volatilization	140	Once in 11 years	0.13	0.013	770	0.39
Fire	0.57	Once in 1,600 years	0.53	0.055	3,300	1.6
Earthquake	860	Once in 5,000 years	1.8	0.246	14,000	7.0
Coil and tube, cooling tower circulated	13	Once in 14,000 years	13	1.3	78,000	39
Transfer error to Building 211-H	3,700	Once in 14,000 years	1.5	0.16	9,200	4.6
Hydrogen deflagration	1.1	Once in 18,000 years	1.0	0.11	6,400	3.2
Criticality	47,000	Once in 77,000 years	0.029	0.0012	18	0.009

TC

a. Source: TtNUS (1999b).
b. MEI = Maximally exposed individual.

Table D-4. FB-Line radiological accidents and impacts.

			Accident Consequences			
Accident	Maximum curies released	Accident frequency	Noninvolved worker (rem)	MEI[a] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Design basis earthquake, 0.2g intensity[b]	0.31	Once in 5,000 years	0.34	0.042	150	0.077
Propagated fire[c]	2.2	Once in 59,000 years	0.18	0.14	1,100	0.53

a. MEI = Maximally exposed individual.
b. Source: WSRC (1993).
c. Source: WSRC (1995).

Cask Decontamination Waste Released to Environment (TS-3)

Casks would be washed at receipt and before shipping. The wash liquid probably would be collected in a sump or storage tank and released to the environment if sample results showed contamination levels to be within acceptable limits. Excessively radioactive or hazardous material could be pumped inadvertently to an outfall rather than to the liquid radioactive waste system or hazardous waste storage if there was an error in processing samples or reading laboratory test results. This scenario assumes that happens and a small amount becomes airborne. The total curies released to air would be 2.0×10^{-7} and would result in negligible consequences. EC This event is postulated to occur once in 100 years of operation. The calculated consequences for this scenario are listed in Table D-7.

Table D-5. Receiving Basin for Offsite Fuel radiological accidents and impacts.[a]

Accident	Maximum curies released	Accident frequency	Accident Consequences			
			Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Fuel rupture	160,000	Once in 1.4 years	0.0018	1.9×10^{-4}	10	0.005
Resin explosion	1.0	Once in 400 years	0.0012	1.3×10^{-4}	7.8	0.0039
Uncontrolled chemical reaction	1,600,000	Once in 450 years	0.018	0.0019	100	0.05
Resin fire	11	Once in 1,200 years	1.3×10^{-4}	1.4×10^{-5}	0.83	4.2×10^{-4}
Process-induced criticality	4,800	Once in 1,500 years	0.16	0.016	970	0.49
NPH[d] (high winds)						
Fuel breach	1,600,000	Once in 2,600 years	0.13	0.0024	130	0.063
Criticality	48,000	Once in 26,000 years	13	0.22	12,000	6.2
NPH (earthquake)						
Waste tank breach	0.69	Once in 280 years	0.0065	1.1×10^{-4}	6.3	3.2×10^{-3}
Fuel breach	1,600,000	Once in 36,000,000 years	0.13	0.0024	130	0.063
Criticality	48,000	Once in 38,000,000 years	13	0.22	12,000	6.2

a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.
c. Data not available.
d. NPH = Natural Phenomenon Hazard.

TC

Table D-6. Reactor Disassembly Basins radiological accidents and impacts.[a]

Accident	Maximum curies released	Accident frequency	Accident Consequences			
			Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Basin overfill	(c)	Once in 100 years	0	4.6×10^{-4}	(c)	
Mishandling fuel assembly	(c)	Once in 100 years	25	0	0	0
Criticality	4,800	Once in 300 years	0.16	0.016	660	0.3
Basin water draindown	(c)	Once in 500 years	0.055	0.016	(c)	

TC

a. Source: WSRC (1997b), TtNUS (1999a). TC
b. MEI = Maximally exposed individual.
c. Accidents expected to result in low consequences and risks to the onsite worker population and the offsite population. Quantitative estimates of consequences and risks are not available.

Table D-7. Transfer Facility radiological accidents and impacts.[a]

Accident	Maximum curies released	Accident frequency	Accident Consequences: Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Railroad car contamination, TS-1	1.0×10^{-7}	Once in 10 years	1.7×10^{-7}	1.8×10^{-8}	7.4×10^{-4}	3.7×10^{-7}
Sump Release, TS-3	2.1×10^{-7}	Once in 100 years	3.5×10^{-7}	3.6×10^{-8}	1.5×10^{-3}	7.4×10^{-7}

a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.

TC

Cask Criticality From Internal Disruption - Single Shipping Cask (TS-4)

Shipping casks containing spent fuel would be moved between facilities by rail or truck and loaded or unloaded from transports using overhead or mobile cranes. The casks contain internal structures that maintain fuel separation or provide neutron absorption. Casks certified in accordance with regulations of the U.S. Department of Transportation are designed to withstand drops from a specified height. However, if the cask internal structures were not assembled properly, disruption and redistribution of the fuel could occur. In addition, the fuel itself could be damaged or loose its integrity and redistribute itself in a critical configuration. This could produce a criticality at the time of the disruption or later if the cask were filled with water for purging. If this event occurred outdoors, the release would not be filtered. This event is not credible.

TC

Criticality From Fuel Dropped On To Floor Or In To Dry Storage Rack (TS-5)

A criticality accident could result if spent nuclear fuel were dropped in a pile on the floor or dropped into the cask-unloading dry storage rack. The fuel drop could result from operator error or equipment failure in the handling ma-chine or spent fuel structure. Double contingency protection would require the dropping of at least two spent fuel loads (assemblies, canisters, bundles, etc.) before a criticality occurred. In addition, the first drop would have to be unrecovered when the second drop occurred. Procedures would require the recovery of the first fuel dropped before material movement could resume. The effects of a criticality event would be mitigated by shielding and the physical distance of the operators in remote handling operations. This event would occur inside the facility, so released radionuclides would be filtered. This event is not considered credible.

Criticality of Spent Fuel in Several Adjacent Shipping Casks (TS-7)

This event addresses a criticality accident among spent nuclear fuel brought together in multiple shipping or storage casks. Because the nuclear reaction would occur in all the fuel in the array, several casks could be involved. A criticality accident of this nature would produce a direct radiation hazard and would release radioactive contamination if one or more casks were breached. However, a criticality during cask dry storage is not a credible event.

D.3.4.2 Dry Storage Facility Accidents

Spent Nuclear Fuel Dry Storage Process-Related Criticality Accident (SLS-2)

This accident scenario involves criticality resulting from the improper loading of dry storage racks or the mechanical failure of racks. Mechanical failure or collapse could result from a crane impact or structural flaw in the racks. Improper loading would result in sufficient spent nuclear fuel assemblies placed near one another with insufficient neutron absorbers to prevent a criticality. A collapse of the racks would result in sufficient spent fuel assemblies piled near one TC another in the debris with insufficient neutron absorbers to prevent a criticality. This event is TC postulated to occur once in 330 years of operation. The calculated consequences for this scenario are listed in Table D-8.

Natural Phenomenon Hazard-Induced Spent Nuclear Fuel Dry Storage Criticality Accident (SLS-3)

This accident scenario involves a natural phenomenon hazard-induced criticality resulting from an earthquake-induced mechanical failure of racks (e.g., collapse or crane impact and collapse) or a subsequent fission product release resulting from a fuel breach. This event is predicated on the assumption that the facility could withstand an earthquake intact and operational. However, the scenario assumes that the structure that contains the material at risk fails, resulting in the event. This event is postulated to occur once TC in 2,000 years of operation. The calculated consequences for this scenario are listed in Table D-8.

Spent Nuclear Fuel Dry Storage Fission Product Release (SLS-1)

This accident scenario involves the release of fission products from a fuel breach and a simultaneous loss of confinement due to an earthquake. The fuel breach would result from an earthquake-induced mechanical failure or collapse of the storage racks or an earthquake-induced crane impact. This event is postulated to TC occur once in 2,000 years of operation. The calculated consequences for this scenario are listed in Table D-8.

D.3.5 ELECTROMETALLURGICAL TREATMENT ACCIDENT SEQUENCES

Melter Eruption (GFP-1 and MM-1)

The electrometallurgical technology would have two separate melters. The melter eruption postulated event could result from impurities in the glass melt (GFP-1) or the metal melt (MM-1). Impurities could range from water that could cause a steam eruption to chemical contaminants that could react at elevated temperatures and produce a highly exothermic reaction (eruption or deflagration). The scenario assumes that the resulting sudden pressure increase would eject the fissile-material-bearing melt liquid into the processing structure. It also assumes that the energy release would not damage the processing structure and its associated filtered exhaust ventilation system. The melter ventilation systems would remove or dilute explosive mixtures that could build up in the gas space above the molten material. Operating procedures and verifications would prevent the addition of impure or incorrect materials to the melt. Therefore, this event is postulated to occur once in 20 years of operation. TC

If the eruption was large, operating personnel would hear and see it. A small eruption might be detected only by airborne radiation monitors because the remotely-operated melters would be in a heavily shielded area. The effects of the eruption would be mitigated by the melter design, which would include venting methods to respond to an over-pressure event. The melter building structure and the ventilation system would confine particulate radioactive material released in the eruption. The calculated consequences for this scenario are listed in Table D-9 for the molten glass release and Table D-10 for the molten metal spill. Noble gases and tritium released on EC the event would not be filtered.

Earthquake-Induced Fission Product Release and Confinement Failure (GFP-4 and MM-5)

The fission-product-release scenario involves damage to the melter structure and its associated systems that would release fission products. This event assumes that the facility would withstand an earthquake and remain operational. However, it also assumes that the structure that contains the material at risk would fail, resulting in the event. This event is postulated to occur once in 2,000 years of operation. The calculated

Table D-8. Dry Storage radiological accidents and impacts.[a]

TC

Accident	Maximum curies released	Accident frequency	Accident Consequences: Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Criticality in storage, SLS-2	4,800	Once in 330 years	0.16	0.016	660	0.3
Earthquake-induced criticality, SLS-3	48,000	Once in 2,000 years	13	0.22	12,000	6.2
Fuel breach during earthquake, SLS-1	1,100,000	Once in 2,000 years	0.014	0.0015	54.1	0.027

a. Source: TtNUS (1999a).
b. MEI = Maximally expose individual.

Table D-9. Electrometallurgical Treatment radiological accidents and impacts (glass melter only).[a]

TC

Accident	Maximum curies released	Accident frequency	Accident Consequences: Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Melter eruption, GFP-1	1,200	Once in 20 years	1.6×10^{-5}	1.1×10^{-6}	0.04	2.0×10^{-5}
Earthquake-induced fission product release and confinement failure, GFP-4	2,300	Once in 2,000 years	3.2×10^{-5}	2.2×10^{-6}	0.08	4.0×10^{-5}
Melter eruption with loss of ventilation, GFP-1a	1,200	Once in 2,000 years	0.002	2.3×10^{-4}	9.5	0.0047
Earthquake spill with loss of ventilation, GFP-4a	2,300	Once in 200,000 years	0.038	6.2×10^{-4}	26	0.013

a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.

Table D-10. Melt and Dilute Treatment radiological accidents and impacts (these accidents also apply to the metal melter for Electrometallurgical Treatment).[a]

TC

Accident	Maximum curies released	Accident frequency	Accident Consequences: Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Melter eruption, MM-1	0.09	Once in 20 years	7.1×10^{-6}	7.4×10^{-7}	0.03	1.5×10^{-5}
Criticality due to multiple batching 5×10^{17} fissions, MM-4	4,700	Once in 330 years	0.004	4.8×10^{-5}	1.6	0.0008
Earthquake-induced fission product release and confinement failure, MM-5	2,300	Once in 2,000 years	6.8×10^{-5}	5.9×10^{-6}	0.23	1.2×10^{-4}
Melter eruption with loss of ventilation, MM-1a	9,200	Once in 2,000 years	0.71	0.074	3,000	1.5
Process criticality with loss of ventilation, MM-4a	14,000	Once in 33,000 years	0.71	0.074	3,000	1.5
Earthquake-induced spill with loss of ventilation, MM-5a	21,000	Once in 200,000 years	30	0.50	21,000	10

a. Source: TtNUS (1999a), TtNUS (2000).

b. MEI = Maximally exposed individual.

consequences for this scenario are listed in Table D-9 for the glass melt and Table D-10 for the metal melt.

Earthquake-Induced Fission Product Release and Confinement Failure (GFP-4 and MM-5)

The fission-product-release scenario involves damage to the melter structure and its associated systems that would release fission products. This event assumes that the facility would withstand an earthquake and remain operational. However, it also assumes that the structure that contains the material at risk would fail, resulting in the event. This event is postulated to occur once in 2,000 years of operation. The calculated consequences for this scenario are listed in Table D-9 for the glass melt and Table D-10 for the metal melt.

Criticality Accident (MM-4)

Melter design volume limits would prevent a criticality accident. However, to preserve flexibility of operation, there would have to be provision for some excess volume, so a criticality accident could result from charging multiple batches of fissile material to the metal melter. The batching operation would be a procedure-guided operator action. "Double Contingency" would require a second operator to verify the processing steps independently. Therefore, this event is postulated to occur once in 330 years of operation. In the event of a criticality, the process building structure and filtered exhaust system would remain intact and would confine fission products and shield against direct radiation exposure. The calculated consequences for this scenario are listed in Table D-10.

TC

Melter Eruption with Coincident Ventilation Failure (GFP-1a and MM-1a)

This scenario has the same initiating event as the glass melt eruption (GFP-1) or the metal melt eruption (MM-1) but with a coincident failure of the HEPA filtration system. As this event requires both a melter eruption and a ventilation failure, the postulated frequency for this event is once in 2,000 years. The calculated consequences for this scenario are listed in Table D-9 for the molten glass release and Table D-10 for the molten metal spill.

TC

Earthquake-Induced Fission Product Release and Confinement Failure with Coincident Ventilation Failure (GFP-4a and MM-5a)

This scenario has the same initiating event as the glass melt spill (GFP-4) or the metal melt spill (MM-5) but with a coincident failure of the HEPA filtration system. As this event requires both a seismic event and a ventilation failure, the postulated frequency for this event is once in 200,000 years. The calculated consequences for this scenario are listed in Table D-9 for the molten glass release and Table D-10 for the molten metal spill.

TC

Criticality Accident with Coincident Ventilation Failure (MM-4a)

This scenario has the same initiating event as the criticality accident (MM-4), but with a coincident failure of the HEPA filtration system. As this event requires both a criticality and a ventilation failure, the postulated frequency for this event is once in 33,000 years. The calculated consequences for this scenario are listed in Table D-10.

<u>Other Accident Scenarios</u>

Other accident scenarios were considered. However, these accident sequences are not listed here as they had the same or lower consequences as listed accidents, though with a much lower accident frequency.

D.3.6 MELT AND DILUTE TREATMENT FACILITY ACCIDENT SEQUENCES

The accidents for the Melt and Dilute Treatment Facility would be the same for either a new facility or in a renovated reactor building.

TC

Melter Eruption (MM-1)

This event would be identical to the metal melt eruption described as MM-1 in D.3.5. The calculated consequences are presented in Table D-10.

Criticality Accident (MM-4)

The criticality event would be identical to that described for the metal melter as MM-4 in D.3.5. The calculated consequences are presented in Table D-10.

Earthquake-Induced Fission Product Release and Confinement Failure (MM-5)

The fission product release and confinement failure would be identical to that described as MM-5 in D.3.5 The calculated consequences are presented in Table D-10.

Melter Eruption with Ventilation Failure (MM-1a)

This event would be identical to the metal melt eruption with ventilation failure described in D.3.5. The calculated consequences are presented in Table D-10.

Earthquake-Induced Fission Product Release and Confinement Failure with Coincident Ventilation Failure (MM-5a)

TC

This event would be identical to the Earthquake-induced spill with ventilation failure described in D.3.5. The calculated consequences are presented in Table D-10.

Criticality Accident with Coincident Ventilation Failure (MM-4a)

This event would be identical to the Double Batching Criticality with ventilation failure described in D.3.5. The calculated consequences are presented in Table D-10.

<u>Other Accident Scenarios</u>

Other accident scenarios were considered. However, these accident sequences are not listed here as they had the same or lower consequences as listed accidents, though with a much lower accident frequency.

D.3.7 MECHANICAL DILUTION TREATMENT TC

D.3.7.1 <u>Press and Dilute Treatment Accident Sequences</u>

Fission Product Release (SDP-2)

This event assumes that the facility would withstand an earthquake and remain operational. However, it also assumes that the structure that contains the material at risk would fail, resulting in the event. This event is postulated to occur once in 2,000 years of operation. The calculated consequences for this scenario are listed in Table D-11.

Spent Nuclear Fuel-Depleted Uranium Press Process Criticality Accident (SDP-3)

This process-related criticality would result from multiple batches of spent fuel plates introduced into the press or an inadvertent substitution of spent fuel plates for depleted uranium plates. In either instance sufficient spent fuel in the configuration would result in a criticality. This event is postulated to occur once in 330 years of operation. The calculated consequences for this scenario are listed in Table D-11. TC

Earthquake-Induced Fire/Pyrophoric Reaction (SDP-4)

An earthquake-induced fire or pyrophoric reaction would result from friction due to mechanical shredding, electrical or mechanically induced fires on uranium metal fuel, or a fire started by a hydraulic fluid leak that resulted in a subsequent pyrophoric reaction. This event assumes that the facility would withstand an earthquake and remain operational. However, it also assumes that

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the structure that contains the material at risk would fail, resulting in the event. This event is postulated to occur once in 20,000 years of operation. The calculated consequences for this scenario are listed in Table D-11.

Table D-11. Press and Dilute radiological accidents and impacts.[a]

Accident	Maximum curies released	Accident frequency	Accident Consequences: Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
SNF-DU press process criticality, SDP-3	4,700	Once in 330 years	0.004	4.8×10^{-5}	1.6	0.0008
Earthquake induce fission product release, SDP-2	230	Once in 2,000 years	3.2×10^{-6}	2.2×10^{-7}	8.0×10^{-3}	4.0×10^{-6}
Earthquake-induced fire/pyrophoric reaction, SDP-4	2,300	Once in 20,000 years	3.6×10^{-5}	2.6×10^{-6}	0.095	4.8×10^{-5}
Process criticality with loss of ventilation, SDP-3a	14,000	Once in 33,000 years	0.71	0.074	3,000	1.5
Earthquake-induced fission product release with loss of ventilation, SDP-2a	240	Once in 200,000 years	0.010	1.6×10^{-4}	6.6	0.0033

a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.

TC

Fission Product Release with Coincident Ventilation Failure (SDP-2a)

This scenario has the same initiating event as the Fission Product Release Accident (SDP-2), but with a coincident failure of the HEPA filtration system. As this event requires both an earthquake and a ventilation failure, the postulated frequency for this event is once in 200,000 years. The calculated consequences for this scenario are listed in Table D-11. TC

Spent Nuclear Fuel-Depleted Uranium Press Process Criticality Accident (SDP-3a)

This scenario has the same initiating event as the criticality accident (SDP-3), but with a coincident failure of the HEPA filtration system. As this event requires both a criticality and a ventilation failure, the postulated frequency for this event is once in 33,000 years. The calculated consequences for this scenario are listed in Table D-11.

<u>Other Accident Scenarios</u>

Other accident scenarios were considered. However, these accident sequences are not listed here as they had the same or lower consequences as listed accidents, though with a much lower accident frequency.

D.3.7.2 <u>Chop and Dilute Treatment Accident Sequences</u>

Fission Product Release (SS-2)

This event assumes that the facility would withstand an earthquake and remain operational. However, it also assumes that the structure that contains the material at risk would fail, resulting in the event. This event is postulated to occur once in 2,000 years of operation. The calculated consequences for this scenario are listed in Table D-12. TC

Spent Nuclear Fuel Shredding Process Criticality Accident (SS-3)

This process-related criticality would result from feeding multiple batches of spent fuel to the fuel

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shredder. This would result in sufficient spent fuel in a configuration that could result in a criticality. This event is postulated to occur once in 330 years of operation. The calculated consequences for this scenario are listed in Table D-12.

Earthquake-Induced Fire/Pyrophoric Reaction (SS-4)

An earthquake-induced fire or pyrophoric reaction could result from friction due to mechanical shredding, electrical or mechanically induced fires on uranium metal fuel, or a fire started by a hydraulic fluid leak that resulted in a subsequent pyrophoric reaction. This event assumes that the facility would withstand an earthquake and remain operational. However, it also assumes that the structure that contains the material at risk would fail, resulting in the event. This event is postulated to occur once in 2,000 years of operation. The calculated consequences for this scenario are listed in Table D-12.

Table D-12. Chop and Dilute radiological accidents and impacts.[a]

Accident	Maximum curies released	Accident frequency	Accident Consequences: Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Process criticality, SS-3	4,700	Once in 330 years	0.004	4.8×10^{-5}	1.6	0.0008
Earthquake-induced fission product release, SS-2	0.07	Once in 2,000 years	1.2×10^{-7}	1.2×10^{-8}	4.9×10^{-4}	2.5×10^{-7}
Earthquake-induced fire, SS-4	2.3	Once in 2,000 years	3.6×10^{-6}	3.8×10^{-7}	0.015	7.7×10^{-6}
TC Process criticality with loss of ventilation, SS-3a	14,000	Once in 33,000 years	0.71	0.074	3,000	1.5
Earthquake release with loss of ventilation, SS-2a	66	Once in 200,000 years	0.012	0.0012	49	0.024
Earthquake-induced fire with loss of ventilation, SS-4a	2,100	Once in 200,000 years	3	0.050	2,100	1.0

a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.

Fission Product Release with Coincident Ventilation Failure (SS-2a)

This scenario has the same initiating event as the Fission Product Release Accident (SS-2), but with a coincident failure of the HEPA filtration system. As this event requires both an earthquake and a ventilation failure, the postulated
TC frequency for this event is once in 200,000 years. The calculated consequences for this scenario are listed in Table D-12.

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Spent Nuclear Fuel Shredding Process Criticality Accident (SS-3a)

This scenario has the same initiating event as the criticality accident (SS-3), but with a coincident failure of the HEPA filtration system.

As this event requires both a criticality and a ventilation failure, the postulated frequency for this event is once in 33,000 years. The calculated consequences for this scenario are listed in Table D-12.

Other Accident Scenarios

Other accident scenarios were considered. However, these accident sequences are not listed here as they had the same or lower consequences as listed accidents, though with a much lower accident frequency.

D.3.8 VITRIFICATION FACILITIES

D.3.8.1 Glass Material Oxidation and Dissolution System Accident Scenarios

Melter Eruption (GMF-1)

The postulated melter eruption could result from impurities in the metal melt. Impurities could range from water that could cause a steam eruption to chemical contaminants that could react at elevated temperatures and produce a highly exothermic reaction (eruption or deflagration). This scenario assumes that the resulting sudden pressure increase would eject the fissile-material-bearing melt liquid into the processing structure. It also assumes that the energy release would not damage the processing structure and its associated filtered exhaust ventilation system. The melter offgas and inerting systems would remove or dilute explosive mixtures that might build up in the gas space above the molten material. Operating procedures and verifications prevent the addition of impure or incorrect materials to the melt. Therefore, this event is postulated to occur once in 20 years of operation.

If a large eruption did occur, the appearance and sound would alert operating personnel. A small eruption might be detected only by airborne radiation monitors because the remotely operated melters would be in a heavily shielded area. The effects of the eruption would be mitigated by the design of the melter, which would include venting methods to respond to an over-pressure event. The melter building structure and the ventilation system would confine particulate radioactive material released in the eruption. The calculated consequences for this scenario are listed in Table D-13.

Criticality Accident (GMF-4)

Melter design volume limits would prevent a criticality accident. However, to preserve flexibility of operation, there would have to be provision for some excess volume, a criticality accident could result from charging multiple batches of fissile material to the metal melter. The batching operation would be a procedure-guided operator action. "Double Contingency" would require a second operator to verify the processing steps independently. Therefore, this event is postulated to occur once in 33,000 years of operation. In the event of a criticality, the process building structure and filtered exhaust system would remain intact and would confine fission products and shield against direct radiation exposure. The calculated consequences for this scenario are listed in Table D-13.

Earthquake-Induced Fission Product Release and Confinement Failure (GMF-5)

The fission-product-release scenario involves damage to the melter structure and its associated systems that would release fission products. This event assumes that the facility would withstand an earthquake and remain operational. However, it also assumes that the structure that contains the material at risk would to fail, resulting in the release. This event is postulated to occur once in 2,000 years of operation. The calculated consequences for this scenario are listed in Table D-13.

Table D-13. GMODS radiological accidents and impacts.[a]

			Accident Consequences			
Accident	Maximum curies released	Accident frequency	Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Melter eruption, GMF-1	1,200	Once in 20 years	1.6×10^{-5}	1.1×10^{-6}	0.04	2.0×10^{-5}
Criticality due to multiple batching 5×10^{17} fissions, GMF-4	4,700	Once in 330 years	0.004	4.8×10^{-5}	1.6	0.0008
Earthquake-induced fission product release and confinement failure, GMF-5	2,300	Once in 2,000 years	3.3×10^{-5}	2.2×10^{-6}	0.08	4.0×10^{-5}
Melter eruption with loss of ventilation, GMF-1a	1,200	Once in 2,000 years	0.0024	2.6×10^{-4}	10	0.0052
Process criticality with loss of ventilation, GMF-4a	14,000	Once in 33,000 years	0.71	0.074	3,000	1.5
Earthquake-induced release with loss of ventilation, GMF-5a	2,300	Once in 200,000 years	0.041	6.8×10^{-4}	28	0.014

TC

a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.

Melter Eruption with Coincident Ventilation Failure (GMF-1a)

This scenario has the same initiating event as the melter eruption (GMF-1), but with a coincident failure of the HEPA filtration system. As this event requires both a melter eruption and a ventilation failure, the postulated frequency for this event is once in 2,000 years. The calculated consequences for this scenario are listed in Table D-13.

Earthquake-Induced Fission Product Release and Confinement Failure with Coincident Ventilation Failure (GMF-4a)

This scenario has the same initiating event as the earthquake-induced melt spill (GMF-4), but with a coincident failure of the HEPA filtration system. As this event requires both a seismic event and a ventilation failure, the postulated frequency for this event is once in 200,000 years. The calculated consequences for this scenario are listed in Table D-13.

Criticality Accident with Coincident Ventilation Failure (GMF-4a)

This scenario has the same initiating event as the criticality accident (GMF-4), but with a coincident failure of the HEPA filtration system. As this event requires both a criticality and a ventilation failure, the postulated frequency for this event is once in 33,000 years. The calculated consequences for this scenario are listed in Table D-13.

Other Accident Scenarios

Other accident scenarios were considered. However, these accident sequences are not listed here as they had the same or lower consequences as listed accidents, though with a much lower accident frequency.

D.3.8.2 Plasma Arc Accident Scenarios

Melter Eruption (GMF-1), Criticality Accident (GMF-4), and Earthquake-Induced Fission Product Release and Confinement Failure (GMF-5) and Corresponding Events with Coincident Loss of Ventilation (GMF-1a, 4a, and 5a) TC

These events are identical in description to GMF-1, GMF-1a, GMF-4, GMF-4a, GMF-5, and GMF-5a as described in D.3.8.1 for the Glass Material Oxidation and Dissolution System accident scenarios. The calculated consequences for these scenarios are listed in Table D-14. TC

Other Accident Scenarios

Other accident scenarios were considered. However, these accident sequences are not listed here as they had the same or lower consequences as listed accidents, though with a much lower accident frequency.

D.3.8.3 F Canyon Dissolve and Vitrify Treatment Accident Sequences

Melter Eruption (GMF-1), Criticality Accident (GMF-4), and Earthquake-Induced Fission Product Release and Confinement Failure (GMF-5) and Corresponding Events with Coincident Loss of Ventilation (GMF-1a, 4a, and 5a) TC

These events are identical in description to GMF-1, GMF-1a, GMF-4, GMF-4a, GMF-5, and GMF-5a as described in D.3.8.1 for the Glass Material Oxidation and Dissolution System accident scenarios. The calculated consequences for these scenarios are listed in Table D-15. TC

Table D-14. Plasma Arc radiological accidents and impacts.[a]

Accident	Maximum curies released	Accident frequency	Accident Consequences: Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Melter eruption, GMF-1	1,200	Once in 20 years	1.6×10^{-5}	1.1×10^{-6}	0.040	2.0×10^{-5}
Criticality due to multiple batching 5×10^{17} fissions, GMF-4	4,700	Once in 330 years	0.004	4.8×10^{-5}	1.6	0.0008
Earthquake-induced fission product release and confinement failure, GMF-5	2,300	Once in 2,000 years	3.3×10^{-5}	2.2×10^{-6}	0.080	4.0×10^{-5}
Melter eruption with loss of ventilation, GMF-1a	1,200	Once in 2,000 years	0.0062	6.4×10^{-4}	26	0.013
Process criticality with loss of ventilation, GMF-4a	14,000	Once in 33,000 years	0.71	0.074	3,000	1.5
Earthquake-induced release with loss of ventilation, GMF-5a	2,400	Once in 200,000 years	0.10	0.0017	71	0.035

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a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.

Table D-15. F Canyon Dissolve and Vitrify radiological accidents and impacts.[a]

Accident	Maximum curies released	Accident frequency	Accident Consequences: Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Glass melt eruption, GMF-1	1,200	Once in 20 years	1.3×10^{-5}	1.2×10^{-6}	0.044	2.2×10^{-5}
Criticality due to multiple batching, GMF-4	4,700	Once in 330 years	0.004	4.8×10^{-5}	1.6	0.0008
Earthquake-induced fission product release and confinement failure, GMF-5	2,300	Once in 2,000 years	2.5×10^{-5}	2.4×10^{-6}	0.088	4.4×10^{-5}
Glass melt eruption with loss of ventilation, GMF-1a	1,200	Once in 2,000 years	0.0019	2.8×10^{-4}	11	0.0056
Process criticality with loss of ventilation, GMF-4a	14,000	Once in 33,000 years	0.71	0.074	3,000	1.5
Earthquake-induced release with loss of ventilation, GMF-5a	2,300	Once in 200,000 years	0.051	8.1×10^{-4}	32	0.016

TC

a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.

Other Accident Scenarios

Other accident scenarios were considered. However, these accident sequences are not listed here as they had the same or lower consequences as listed accidents, though with a much lower accident frequency.

D.3.8.4 New Dissolve and Vitrify Facility

Melter Eruption (GMF-1), Criticality Accident (GMF-4) and Earthquake-Induced Fission Product Release and Confinement Failure (GMF-5) and Corresponding Events with Coincident Loss of Ventilation (GMF-1a, 4a, and 5a)

These events are identical in description to GMF-1, GMF-1a, GMF-4, GMF-4a, GMF-5, and GMF-5a as described in D.3.8.1 for the Glass Material Oxidation and Dissolution System accident scenarios. The calculated consequences for these scenarios are listed in Table D-16.

Other Accident Scenarios

Other accident scenarios were considered. However, these accident sequences are not listed here as they had the same or lower consequences as listed accidents, though with a much lower accident frequency.

D.4 Comparison of Accident Impacts for Alternative Facility Locations

An alternative location for new facilities would be C-Area. If DOE located the facilities in C-Area, doses to the MEI and the population would be expected to be approximately 4.0 percent and 12 percent higher, respectively, due to the shorter distance to the Site boundary.

D.5 Impacts of Postulated Accidents Involving Nonradioactive Hazardous Materials

This section summarizes the impacts of potential accidents involving hazardous chemicals at the Receiving Basin for Offsite Fuel as documented in the safety analysis report for the facility (WSRC 1995). These accidents would not involve radioactive materials.

Table D-16. New Dissolve and Vitrify radiological accidents and impacts.[a]

			Accident Consequences			
Accident	Maximum curies released	Accident frequency	Noninvolved worker (rem)	MEI[b] (rem)	Offsite population (person-rem)	Latent cancer fatalities
Glass melt eruption, GMF-1	1,200	Once in 20 years	1.6×10^{-5}	1.1×10^{-6}	0.04	2.0×10^{-5}
Criticality due to multiple batching GMF-4	4,700	Once in 330 years	0.004	4.8×10^{-5}	1.6	0.0008
Earthquake-induced fission product release and confinement failure, GMF-5	2,300	Once in 2,000 years	3.3×10^{-5}	2.2×10^{-6}	0.08	4.0×10^{-5}
Melter eruption with loss of ventilation, GMF-1a	1,200	Once in 2,000 years	0.0024	2.6×10^{-4}	10	0.0052
Process criticality with loss of ventilation, GMF-4a	14,000	Once in 33,000 years	0.71	0.074	3,000	1.5
Earthquake-induced release with loss of ventilation GMF-5a	2,300	Once in 200,000 years	0.041	6.8×10^{-4}	28	0.014

a. Source: TtNUS (1999a).
b. MEI = Maximally exposed individual.

The hazard analysis documented in the safety analysis report identified three chemical spill events that required unique accident analyses. This section describes the analysis of these events, which include chemical spills of sodium hydroxide, nitric acid, and sodium nitrite from storage dumpsters outside the facility.

D.5.1 LOSS OF 50-PERCENT SODIUM HYDROXIDE CONTAINMENT

Sodium hydroxide (NaOH), used for anion resin regeneration, is stored in a skid-mounted 1,000-gallon dumpster on a chemical pad west of Building 245-H. This dumpster is typically filled to 900 gallons and is heated during the winter to approximately 10 to 12°F above the crystallization point using 25-psi steam routed through piping inside the dumpster.

If an initiating event occurred that ruptured the tank, the chemical would accumulate in the bermed area of the pad. The rate of leakage from the dumpster would depend on the point of the breach and the severity of the opening. A worst-case breach would drain the contents of the dumpster within minutes. This scenario takes no credit for the berm containing the chemical spill. Therefore, the sodium hydroxide would spread over a large area, which would result in a larger airborne release rate than would a bermed release.

The sodium hydroxide plume would be transported by the wind as tiny particles. Therefore, a Gaussian plume model is appropriate. This event is postulated to occur once in 190 years of operation.

The calculated concentration would be lower than the lowest concentration guideline (PEL-TWA) for either on- or offsite. Therefore, the consequences of the release would be insignificant and there is no need for further analysis at greater distances.

D.5.2 LOSS OF 50-PERCENT NITRIC ACID CONTAINMENT

DOE uses nitric acid (HNO_3) in the regeneration of cation resin, and stores it in a skid-mounted 1,000-gallon dumpster west of Building 245-H. The dumpster is typically filled to 900 gallons. Nitric acid is supplied to the Resin Regeneration Facility through underground piping. The chemical pad is approximately at ground level outside the Receiving Basin for Offsite Fuel and the Resin Regeneration Facility. It is surrounded by a dike to contain spills.

If an initiating event occurred that ruptured the tank, the chemical would accumulate in the bermed area of the pad. The rate of leakage from the dumpster would depend on the point of the breach and the severity of the opening. A worst-case breach would drain the contents of the dumpster within minutes. This scenario takes no credit for the berm containing the chemical spill. Therefore, the nitric acid would spread over a large area, which would result in a larger airborne release rate than would a bermed release. This event is postulated to occur once in 190 years of operation.

The release would result in a concentration of 3.1×10^{-3} milligrams per cubic meter at 640 meters (2,100 feet) and 4.0×10^{-4} milligrams per cubic meter at the nearest Site boundary. These values are both lower than the Emergency Response Planning Guideline-2 values.

D.5.3 LOSS OF 30-PERCENT SODIUM NITRITE CONTAINMENT

DOE stores sodium nitrite ($NaNO_2$), a waste tank corrosion inhibitor, in a skid-mounted 1,000-gallon dumpster on a chemical pad west of Building 245-H. The contents of the dumpster are pumped to an adjacent Holdup Tank with a maximum capacity of 1,600 gallons. This analysis assumes that the contents of both tanks are filled to their total combined volume of 2,600 gallons. The chemical pad is approximately at ground level outside the Receiving Basin for Offsite Fuel and the Resin Regeneration Facility, and is surrounded by a dike.

If an initiating event occurred that ruptured the tank, the chemical would accumulate in the bermed area of the pad. The rate of leakage from the dumpster or holdup tank would depend on the point of the breach and the severity of the opening. A worst-case breach would drain the contents of the dumpster or holdup tank within minutes. This scenario takes no credit for the berm containing the chemical spill. Therefore, the sodium nitrite would spread over a large area, which would result in a larger airborne release rate than would a bermed release. This event is postulated to occur once in 180 years of operation.

The calculated airborne concentration at a downwind distance of 100 meters (328 feet) would be 0.006 milligrams per cubic meter, which is less than the lowest concentration guideline (PEL-TWA). Therefore, the consequences of the release would be insignificant, and there is no need for analysis at greater distances.

D.5.4 SURFACE VEHICLE IMPACT

The impact of a surface vehicle with a chemical dumpster has been identified as a potential initiating event for chemical leakage. The consequences of the events would be the same as the consequences for the events analyzed in Sections D.5.1 through D.5.3. The postulated frequency for each of these chemical releases from surface vehicle impact would be once in 3,400 years.

D.6 Environmental Justice

In the event of an accidental release of radioactive or hazardous chemical substances, the dispersion of such substances would depend on meteorology conditions, such as wind direction, at the time. Given the variability of meteorology conditions and the low probability and risk of accidents, an accident would be unlikely to occur that would result in disproportionately high or adverse human health and environmental impacts to minorities or low-income populations.

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